5 Clearing and Grading

In this chapter...

- *Techniques to minimize site disturbance*

Protecting native soil and vegetation and retaining hydrologic function during the clearing and grading phase presents one of the most significant challenges within the development process. Upper soil layers contain organic material, soil biota, and a structure favorable for storing and slowly conducting stormwater down gradient. Clearing and grading exposes and compacts underlying subsoil, producing a site with significantly different hydrologic characteristics. On till soil, precipitation is rapidly converted to overland flow. Surface and interflow are usually less on sites with native outwash soils and vegetation compared to native till conditions. Accordingly, the increase in overland flow from pre- to post-construction conditions can be greater on outwash than till sites if impervious areas are not minimized and soil structure is not protected for infiltration.

In addition to hydrologic modifications, sediment yield from clearing, grading and other construction activities can significantly affect receiving waters. Gammon found that stream biota was significantly reduced at suspended solids levels of 50 to 80mg/L (Corish, 1995). Schueler reported a median total suspended solids concentration of 4,145 mg/L leaving construction sites without erosion and sediment control and 283 mg/L at sites with controls (the range of concentrations with controls—11 to 2,070 mg/L in the study—was highly variable) (Corish, 1995). Typically, sediment and erosion is managed through structural practices; however, reliance on structural approaches alone to compensate for widespread vegetation loss can add unnecessary construction costs and may not provide adequate protection for aquatic habitat and biota. Minimizing site disturbance as a primary strategy to control erosion reduces the extent of grading, retains vegetation cover, and is the most cost-efficient and effective method for controlling sediment yield (Corish, 1995).

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Several factors including topography, hydrology, zoning density and plat design, and housing type influence the timing and extent of clearing and grading activities. The scope of this section does not include the regulatory and market structure influencing clearing and grading, but rather focuses on planning and implementation techniques to reduce impacts to native soils, vegetation, and hydrology on the site.

Proper installation and maintenance of erosion and sediment control **best management practices** (BMPs) are required during the clearing, grading, and construction phases of a project. For detailed guidelines and specifications for erosion and sediment control BMPs see Washington State Department of Ecology 2005 *Stormwater Management Manual for Western Washington* Volume II chapter 4.

5.1 Techniques to Minimize Site Disturbance

Planning and implementation techniques to minimize site disturbance fall into four categories:

- **Site design**
- **Construction planning**
- **Training**
- **Equipment**

5.1.1 Efficient Site Design

- Reduce the overall development envelope and maximize protection of native soils and vegetation with efficient road layout and cluster design (see Chapter 3: Site Planning and Layout).
- Retain natural topographic features that slow and store storm flows.
- Do not increase steep continuous slopes.
- Limit overall project cut and fill through efficient road design and lot layout.
- Minimize cut and fill by orienting the long axis of buildings along contours or staggering floor levels for buildings to adjust to gradient changes.
- Use minimal excavation foundation systems to reduce grading (see Section 6.5 Minimal Excavation Foundations for details).
- Limit clearing and grading disturbance to road, utility, building pad, landscape areas, and the minimum additional area needed to maneuver equipment (a 10-foot perimeter around the building site can provide adequate work space for most activities).
- Limit the construction access to one route if feasible, and locate access where future roads and utility corridors will be placed.

5.1.2 Coordinated Planning and Activities among Construction Entities

- Begin clearing, grading and heavy construction activity during the driest months and conclude by late fall when rainfall and associated soil compaction, erosion, and sediment yield from equipment activity increases. Late fall is also when conditions are most favorable for establishing vegetation.
- Plan efficient sequencing of construction phases to reduce equipment activity and potential damage to soil and vegetation protection areas.
- Establish and maintain erosion and sediment controls before or immediately after clearing and grading activity begins.
- Phase project to complete operations in one section of the site before clearing and grading the next. Project phasing is challenging when coordinating utility, road, and other activities (Corish, 1995). The greatest potential to implement and benefit from phasing will be on large projects where extensive exposed areas are difficult to stabilize over long periods.
- Map native soil and vegetation protection areas on all plans and delineate these areas on the site with appropriate fencing to protect soils and vegetation from clearing, grading, and construction damage. Fencing should provide a strong physical and visual barrier of high strength plastic or metal and be a minimum of 3 to 4 feet high (see Ecology 2005 SMMWW BMP C103 and

C104). Silt fencing, or preferably a compost berm, is necessary in addition to, or incorporated with, the barrier for erosion control.

- Stockpile materials in areas designated for clearing and grading (avoid areas within the development envelope that are designated for bioretention or other bioretention areas).
- Stockpile and reuse excavated topsoil to amend disturbed areas (see Section 6.2: Amending Construction Site Soils for details).
- Small stockpiles of soil should be covered and larger piles seeded for erosion control during wet months.
- Inspections (Corish, 1995):
  - o Conduct a pre-construction inspection to determine that adequate barriers have been placed around vegetation protection areas and structural controls are implemented properly.
  - o Routine inspections should be conducted to verify that structural controls are maintained and operating effectively throughout construction, and that soil structure and vegetation are maintained within protection areas.
  - o Conduct a final inspection to verify that re-vegetated areas are stabilized and that stormwater management systems are in place and functioning properly.

5.1.3 Training Personnel Implementing Project Activities

- Install signs to identify limits of clearing and grading, and explain the use and management of the natural resource protection areas.
- Meet and walk the property with equipment operators regularly to clarify construction boundaries, limits of disturbance, and construction activities.
- Require erosion and sediment control training for operators.

5.1.4 Proper Equipment

Research in the agricultural setting indicates that ground contact pressure generally determines the potential for compaction in the upper 6 to 8 inches of soil while total axle load can influence compaction in the deeper subsoil layers. Vehicles with tracks or tires with axle loads exceeding 10 tons per axle can compact soils as deep as 3 feet (Delong-Hughes, Moncrief, Voorhees and Swan, 2001). A majority of the total soil compaction (70 to 90 percent) can occur in the first pass with equipment (Balousek, 2003).

To minimize the degree and depth of compaction, use equipment with the least ground pressure to accomplish tasks. For smaller projects, many activities can be completed with mini-track loaders that are more precise, require less area to operate, exert less contact pressure than equipment with deep lugged tires, and have lower total axle weight (personal communication, James Lux, August 2004).